



IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 Issue: II Month of publication: February 2017 DOI: http://doi.org/10.22214/ijraset.2017.2039

www.ijraset.com

Call: 🕥 08813907089 🔰 E-mail ID: ijraset@gmail.com

### International Journal for Research in Applied Science & Engineering Technology (IJRASET)

## **Experimental Investigation of Partial Replacement of Sand by** Laterite Soil in Concrete

J. Vengadesh Marshall Raman<sup>1</sup>, R. Kirubakaran<sup>2</sup> <sup>1</sup>Assistant professor, Civil Department, Mailam Engineering College, Mailam <sup>2</sup>Student, Civil Department, Mailam Engineering College, Mailam

Abstract: The attention of most researchers is shifting towards the optimization of building materials by using local contents; the use of indigenous materials; and local industrial by-products unique and abundant in certain localities. Concrete were made with laterite soil taken from different sources replacing the conventional fine aggregate (local river sand) in steps of 5% up to 20%. Their compressive strengths and split tensile strength determined to check for conformity with concrete as with a view of small scale to determine the acceptable percentage 0%, 5%,10%,15%, & 20% replacement. Laterized concrete structures have potentially sufficient strength compared with that of normal concrete. Soil tests were performed on the laterite soil samples to characterize the soils. Classification of the lateritic soil samples within Mailam, revealed that the lateritic soils are mostly sandy clay of high plasticity and may replace sand by up to 20%, though an approximate linear decrease in strength with increasing sand replacement with lateritic soil was observed. In the compressive strength test, cube -30 numbers of 150 mmx150 mm, split tensile strength test cylinder -30 numbers laterite concrete sizes were produced and crushed with the under compressive machine to determine their twenty-eight day compressive strength of specimens. The process of selecting suitable ingredients of concrete and determining their relative amounts with an objective of producing a concrete of required strength as economically as possible is termed as concrete mix design. The Mix Design for concrete M25 grade is being done as per the Indian Standard Code IS: 10262-2009.

Keywords— Fine Aggregate, Laterite Soil, Compressive Strength, Split Tensile Strength, Workability.

### I. INTRODUCTION

High cost of building materials has been the bane of construction industry in the developing countries of the world as a result of importation of most of the building materials. Laterite soil possesses other advantages which makes it potentially a very good and appropriate material for construction, especially for the construction of rural structures in the developing countries. This study is specifically focused on the effects of replacement of the conventional fine aggregate (sand) with lateritic soils found in Ota on the compressive strengths of concrete. Laterite soil possesses other advantages which makes it potentially a very good and appropriate material for construction, especially for the construction of rural structures in the developing countries.

Lasisi and Ogunjimi, (1984) These merits include little or no specialized skilled labour required for laterized concrete production and for its use in other construction works; and laterized concrete structures have potentially sufficient strength compared with that of normal concrete. From an engineering point of view, laterite or lateritic soil is a product with red, reddish brown and dark brown colour, with or without nodules, ability to self-harden, concretions, and generally (but not exclusively) found below hardened ferruginous crusts or hard plan (Ola, 1983). Lasisi and Ogunjide (1984) assert that the degree of laterization is estimated by the silica sesquioxides ratio (SiO2/ (Fe2O3 + Al2O3)). Silica-Sesquioxide (S-S) ratio less than 1.33 are indicative of laterites, those between 1.33 and 2.00 are lateritic soils and those greater than 2.00 are non-lateritic types. Studies are currently going on in the use of lateritic soil in concrete production where laterite is made to partly or wholly replace conventional fine aggregate in the production of concrete known as laterized concrete; and in the production of concrete units such as Compressed Laterized concrete (CLC) usually stabilized with cement. Presently, these applications are mostly limited to buildings in rural areas and low income housing projects which are mostly situated at satellite areas (outskirts) of Central Business Areas (CBA's).

### **II. MATERIALS**

### A. Cement

Ordinary Portland cement (OPC 43 grade) is used as the main binder conforms to IS: 8112 -1991 were used. The physical properties of cement obtained and used are given in Table 1

Volume 5 Issue II, February 2017 ISSN: 2321-9653

### International Journal for Research in Applied Science & Engineering

### **Technology (IJRASET)**

Table 1: Physical properties of 43 grade OPC

Sl.no	Properties	Values
1	Fineness	5%
2	Initial setting time	30 mines
3	Final setting time	600 mines
4	Standard consistency	29%
5	Specific gravity	3.1

#### B. Fine Aggregate

For the present investigation, fine aggregate tested as per IS: 383-1970. In the present investigation fine aggregate is natural sand from local market is used. The physical properties of fine aggregate like specific gravity, gradation and fineness modulus are tested in accordance with IS: 383-1970

ruble 2. Infision properties of Thie Highegue			
Sl.no	Properties	Values	
1	Size	Passing through 4.75mm	
2	Fineness Modulus	3.225	
3	Water Absorption	3.7%	
5	Specific gravity	2.71	

#### Table 2: Physical properties of Fine Aggregate

#### C. Coarse Aggregate

The crushed coarse aggregate of 20 mm maximum size rounded obtained from the local crushing plant. The physical properties of coarse aggregate are tested in accordance with IS; 383-1970.

	<b>v</b> 1 1	
Sl.no	Properties	Values
1	Size	20mm
2	Water Absorption	1.56%
3	Specific gravity	2.79
2 3	Water Absorption Specific gravity	1.56% 2.79

Table 5. Flightal properties of Coarse Aggregat		Table 3:	Physical	properties	of Coarse	Aggregate
---	--	----------	----------	------------	-----------	-----------

#### D. Laterite soil

This study investigates the suitability of laterite soil as fine aggregate in place of sand, and specifically seeks to determine whether laterized concrete would satisfy the minimum compressive strength requirement of BS 8110 (1997) for use in reinforced concrete works, which is 25 N/mm2.

Sl.no	Properties	Values	
1	Size	Passing through 4.75mm	
2	Fineness Modulus	3.225	
3	Water Absorption	8.84%	
4	Specific gravity	2.6	

Table 4: Physical properties of Laterite Soil

Figure 1 Laterite soil

### International Journal for Research in Applied Science & Engineering Technology (IJRASET)

### III. METHODOLOGY

Concrete were made with laterite soil taken from different sources replacing the conventional fine aggregate (local river sand) in steps of 5% up to 20%. Their compressive strengths and split tensile strength determined to check for conformity with concrete as with a view of small scale to determine the acceptable percentage 0%, 5%,10%,15%, & 20% replacement. Laterized concrete structures have potentially sufficient strength compared with that of normal concrete. To cast concrete cubes specimen of size  $100 \times 100 \times 100$  and to test the harden cube on 28 days under compression. To cast concrete cylinder specimen of size  $150 \times 300$  and to test the harden cube on 28 days under compression. To cast concrete cylinder specimen of M25 concrete mixes were collected and casted. The conventional concrete was cured in water. The tests on conventional and laterite concrete specimens were conducted 7dyas and 28days. The result were analyzed and discussed with comparisons of the two types of concrete and their properties.

### IV. RESULT AND DISCUSSIONS

A. Compressive Strength

	Table 5 Compressive strength for cubes		
Sl.no	Replacement %	7 days compressive	28 days compressive
		strength	strength
1	0%	21.77	31.11
2	5%	20.14	26.62
3	10%	20.22	28.14
4	15%	21.59	30.37
5	20%	19.20	28.88



Figure 2 Compressive strength for cubes

### B. Split Tensile Strength

Table 0. Split Tensile Strength				
Sl.no	Replacement %	7 days (N/mm <sup>2</sup> )	28 days (N/mm <sup>2</sup> )	
1	0%	1.72	2.45	
2	5%	1.34	1.88	
3	10%	1.43	2.07	
4	15%	1.60	2.24	
5	20%	1.48	2.17	

#### Table 6: Split Tensile Strength

### International Journal for Research in Applied Science & Engineering Technology (IJRASET)



Figure 3. Split Tensile Strength

### **V. CONCLUSION**

From the above given compressive and split tensile strength values, we calculated that 15% is the optimum value. The presence of coarse grained good quality-laterite in the making of concrete would maximum 5% to20% partial replacement of laterite soil using the construction work.

### **VI. FURTHER STUDIES**

The future studies and research right based on the characteristics and properties of laterite soil along with sand as partial replacement for different grades

In the same manner, the research on laterized concrete can be continued with the following aim.

To get optimized mix proportioning for high strength laterized concrete by Indian standard methods.

To get laterized concrete for grade beyond 40 Mpa.

To get the economical and eco-friendly laterized concrete by satisfying all the durability conditions.

### REFERENCES

- [1] Felix F. Udoeyo, Robert Brooks, Philip Udo-Inyang & Alonge M. Kehinde"Influence of specimen geometry on the strength of laterized" April 2010.
- [2] Gidigasu, M.D., Lateritic Soil Engineering: Pedogenesis and Engineering Principles. Elsevier Scientific Publishing Company, New York. 6p, 1976.
- [3] Festus Adeyemi Olutoge1, Kikelomo Mulikat Adeniran, Oluwatobi Brian Oyegbile. "The ultimate strength behaviour of laterite concrete Beam".
- [4] Ata oluhbenga "Effects of varying curing age water/cement ratio on the elastic roperties of laterzed concrete September -2007.
- [5] Theophilus Yisa Tsado, An investigation into structural strength of laterized concrete.
- [6] Viso, J J., Carmona, R. and Ruiz, G.Shape and Size Effects on the Compressive Strength of High Strength Concrete.Cement and Concrete Research.38 (3): 386-395, 2008.
- [7] Mansur, M. A. and Islam, M.M. Interpretation of Concrete Strength for Nonstandard Specimens. ASCE J. Mater., 14 (2): 151-155, 2002.
- [8] Yi,S. T., Yang,I.K. and Chol,J.C. Effect of Specimen Sizes, Specimen Shapes, and Placement Directions on the Compressive Strength of Concrete.Nuclear Engineering and Design.236 (2): 115-127, 2006.
- [9] Enochsson, O., Lundqvist, J., Täljsten B., Rusinowski, P. and Olofsson, T. CFRP Strengthened Openings in Two-way Concrete Slabs An Experimental and Numerical Study. Construction and Building Materials. 21(1): 810-826, 2006.
- [10] Olawuyi, B. J. and Olusola, K. O. Compressive Strength of Volcanic Ash/Ordinary Portland Laterized Concrete. Civil Engineering Dimension. 12(1): 23–28, 2010.
- [11] Oluwaseyi, 'Lanre, "The Influence of Weather on the Performance of Laterized Concrete. Journal of Engineering and Applied Sciences. 2(1): 129 135, 2007.
- [12] Ayangade, J.A., Alake, O., and Wahab, A.B. The Effects of Different Curing Methods on the Compressive Strength of Terracrete. Civil Eng. Dimension. 2(1): 41-45, 2009.
- [13] Udoeyo, F. F., Brooks, R., Udo-Inyang, P., and Iwuji, C. Residual Compressive Strength of Laterized Concrete Subjected to Elevated Temperatures. Research Journal of Applied Sciences, Engineering and Technology. 2(3): 262-267, 2010.
- [14] Ikponmwosa, E. E. and Salau, M. A. Effect of Short Steel Fibre Reinforcement on Laterized Concrete Columns. J. Sustainable Development. 4(1): 230–239, 2011.
- [15] Apeh, J.A. and Ogunbode, E.O. "Strength Performance of Laterized Concrete at Elevated Temperatures," in Proc. 4th WABER Conf., pp289298. July 24-26 2012, Abuja, Nigeria.
- [16] Udoeyo, F.F., Brooks, R., Udo- Inyang, P. and Nsan, R. O., "Early Prediction of Laterized Concrete Strength by Accelerated Testing," IJRRAS, 5(1):10, 2010.
- [17] IS 8112: Specification for Ordinary Portland Cement, Indian Standards, 1989.
- [18] IS 10262: Part 1: Guide to Specifying Concrete, Indian Standards ,2009.
- [19] IS 383: Specification for Aggregates from Natural Sources for Concrete, Indian Standards, 1979.
- [20] IS10262 M25: Mixing and Sampling Fresh Concrete in the Laboratory, Indian Standards, 2009











45.98



IMPACT FACTOR: 7.129







# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 🕓 (24\*7 Support on Whatsapp)